

## **CLAIMS**

What is claimed is:

1. An analog-to-digital converter system, comprising:  
5 a passive delta sigma converter stage comprising:  
a first filter receiving a converter stage analog input and a first analog feedback signal, the first filter being free of switching components and providing a first filtered analog signal according to the converter stage analog input and according to the first analog feedback signal,  
10 a quantizer coupled with the first filter, the quantizer providing a quantized output according to the first filtered analog signal, and  
a first digital-to-analog converter coupled with the first filter and with the quantizer, the first digital-to-analog converter providing the first analog feedback signal according to the quantized output; and  
15 an active gain stage coupled with the passive delta sigma converter stage, the active gain stage receiving a system analog input and providing the converter stage analog input according to the system analog input and the quantized output.
- 20 2. The system of claim 1, wherein the active gain stage comprises:  
a second filter receiving the system analog input and a second analog feedback signal, the second filter being free of switching components;  
a second digital-to-analog converter coupled with the second filter and with the quantizer, the second digital-to-analog converter providing the second  
25 analog feedback signal according to the quantized output; and  
an amplifier coupled with the second filter;  
wherein the amplifier and the second filter provide the converter stage analog input according to a difference between the system analog input and the second analog feedback signal scaled by a gain factor.

3. The system of claim 2, wherein the quantizer comprises a comparator coupled with the first and second digital-to-analog converters, the comparator providing the quantized output according to the first filtered analog  
5 signal.

4. The system of claim 2, wherein the gain factor is about 25 or more.

5. The system of claim 4, wherein the gain factor is about 100.

10 6. The system of claim 2, wherein the second filter is a second order low pass filter.

15 7. The system of claim 6, wherein the first filter is a second order low pass filter.

8. The system of claim 7, wherein poles of the second filter are substantially matched with poles of the first filter.

20 9. The system of claim 2, wherein the first and second digital-to-analog converters individually comprise at least one switched capacitor circuit.

10. The system of claim 1, wherein the active gain stage provides the converter stage analog input according to a difference between the system  
25 analog input and the quantized output scaled by a gain factor.

11. The system of claim 10, wherein the gain factor is about 25 or more.

12. The system of claim 11, wherein the gain factor is about 100.

13. The system of claim 1, wherein the first filter is a second order low pass filter.

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14. The system of claim 1, wherein the first digital-to-analog converter comprises at least one switched capacitor circuit.

15. A data converter system, comprising:

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a passive circuit comprising:

a quantizer in a forward signal path, the quantizer providing a quantized output representative of a quantizer input signal, and

a passive filter coupled with the quantizer in the forward signal path, the passive filter being free of switching components and providing the quantizer input signal according to a converter input and a first feedback signal;

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an active circuit coupled with the passive circuit, the active circuit comprising an active filter in the forward signal path, the active filter being free of switching components and providing the converter input according to a difference between a system analog input and a second feedback signal and according to a gain factor; and

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a feedback circuit in a feedback signal path, the feedback circuit being coupled with the quantizer, the passive filter, and the active filter, the feedback circuit providing the first and second feedback signals according to the quantized output.

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16. The system of claim 15, wherein the passive and active filters are second order low pass filters.

17. The system of claim 16, wherein poles of the active filter are substantially matched with poles of the passive filter.

18. The system of claim 15, wherein poles of the active filter are  
5 substantially matched with poles of the passive filter.

19. The system of claim 15, wherein the gain factor is about 25 or more.

10 20. The system of claim 19, wherein the gain factor is about 100.

21. The system of claim 15, wherein the feedback circuit comprises at least one digital-to-analog converter providing one or more of the first and second feedback signals according to the quantized output.

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22. A fourth order delta sigma analog-to-digital converter, comprising:  
a passive delta sigma modulator comprising a passive filter, a quantizer,  
and a digital-to-analog converter in a first feedback loop; and  
an amplifier in a second feedback loop around the passive delta-sigma  
20 modulator.

23. The converter of claim 22, further comprising a second filter in the second feedback loop.

25 24. The converter of claim 23, wherein the passive filter and the second filter are second order low pass filters.

25. The converter of claim 23, wherein poles of the passive filter are substantially matched with poles of the second filter.

26. The converter of claim 22, wherein a gain factor of the amplifier is about 25 or more.

5 27. The converter of claim 22, wherein a gain factor of the amplifier is about 100.